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Review of educational and other approaches to hearing loss among Indigenous people

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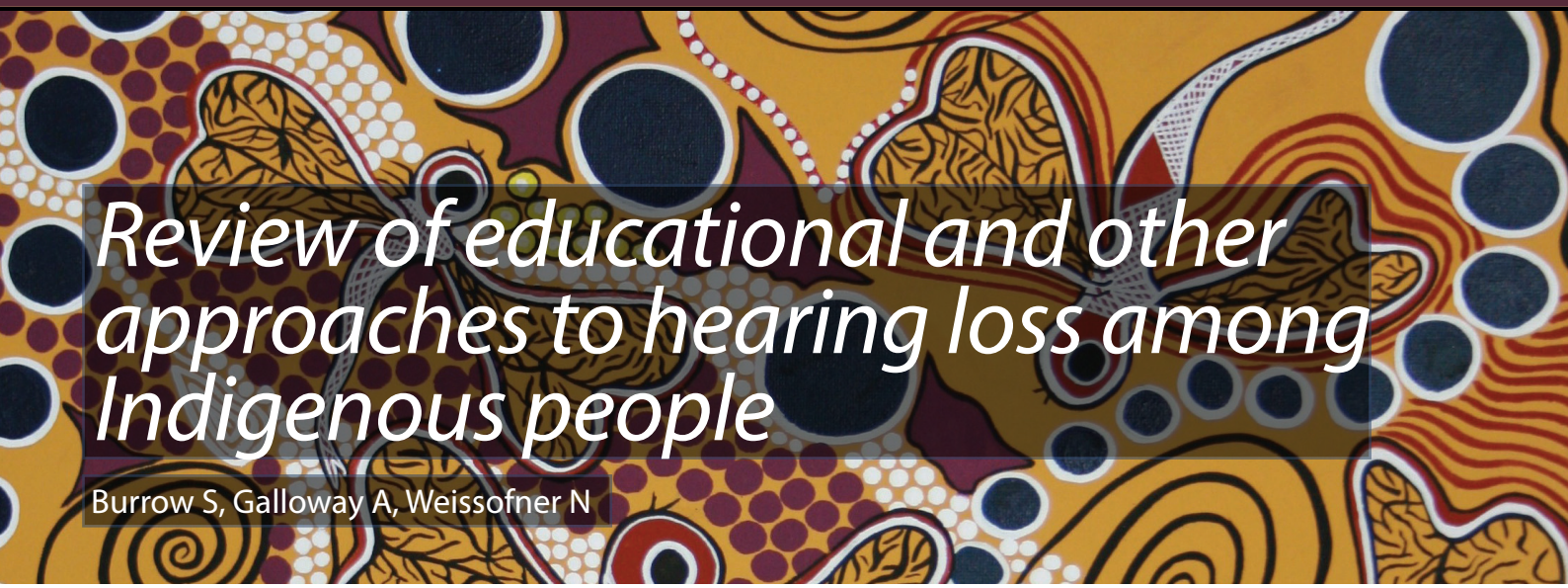

Review of educational and other approaches to hearing loss among Indigenous people

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Introduction

Ear disease and subsequent hearing loss are significant problems in developing countries and among many indigenous populations[1] in developed countries. Exceptionally high rates of ear disease and hearing loss have been reported in many Indigenous Australian communities, particularly in remote areas and among children [1].

Middle ear disease, generally referred to as otitis media (OM), is the most common cause of hearing loss among Indigenous Australians. OM is an inflammation of the middle ear that occurs in various forms. It is caused by bacterial or viral infections and is often the result of another illness (such as a cold) [2, 3]. OM typically leads to conductive hearing loss that is mild to moderate in degree, and may be intermittent or persistent according to the form of OM. Evidence suggests that some forms of OM may lead also to sensorineural hearing loss [2]. Without effective treatment and follow-up, OM may become severe and chronic, increasing the

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1 In this review, a lower case 'i' is used to spell indigenous when referring to indigenous peoples generally. An upper case 'I' is used when referring to both Aboriginal and Torres Strait Islander people, the Indigenous peoples of Australia. There is little documented information regarding the ear health and hearing of Torres Strait Islander people, and much of the information reported here has been obtained from research undertaken with Aboriginal people. There are many culturally distinct groups within the Indigenous Australian population but Aboriginal and Torres Strait Islander people experience similar levels of disadvantage and patterns of ear disease and hearing loss are likely to be similar in both populations.

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risk of permanent hearing loss [2, 3]. For further information about forms of OM and hearing loss, see the Ear*InfoNet* Background information regarding ear health and hearing.

A recent review of the economic impact and cost of hearing loss in Australia reported that one in six people is affected by hearing loss [4]. The review estimated that the financial cost of hearing loss in 2005 was $11.75 billion. The review did not include costs associated specifically with OM-related hearing loss, but noted that these are substantial within the Indigenous population. It also highlighted the significant effects of hearing loss on the capacity to communicate, and in turn to participate in education, gain competitive skills, and form relationships. It identified the need for further research in a range of areas, including Indigenous hearing health. In particular, it called for research regarding the epidemiology of hearing loss and associated risk factors in Indigenous communities, and the nature and extent of intermittent as well as permanent conductive hearing loss and its effects on learning.

Further research is required to clarify various aspects of ear disease and hearing loss among Indigenous children and adults. In recent decades there has been growing recognition of the prevalence of Indigenous ear disease, and medical aspects have received attention from researchers, practitioners and policy makers, but recognition of the implications of hearing loss for Indigenous education has been more limited. It is clear however, that the hearing loss associated with OM has significant developmental, educational, social and vocational consequences for Indigenous children and adults, and compounds the range of disadvantages they experience.

The following review complements the existing Ear*InfoNet* review of the medical aspects of ear disease (see the Review of ear health and hearing) and summarises the available literature regarding educational and other approaches to Indigenous hearing loss. It draws together relevant information from various disciplines in a single document. Particular attention is given to the:

- impact of hearing loss;
- factors contributing to hearing loss;
- prevention and management of otitis media and hearing loss;
- education strategies addressing hearing loss; and
- policies and policy implications for reducing hearing loss and its educational consequences.

The development of this review recognises the need for further research and resources to address the educational aspects of Indigenous hearing loss. It is intended to assist researchers, education professionals, other practitioners and policy makers working in relevant sectors and disciplines. In-depth interpretation of the research findings from across all relevant sectors is beyond the scope of this document, but it is intended that this review make a valuable contribution to future cross-sector discussions and collaborative approaches to the development of relevant policies, strategies and programs.

This review focuses specifically on conductive hearing loss resulting from OM, but it should be noted that higher than average rates of sensorineural hearing loss have also been reported in the Indigenous population [5].

Impact of hearing loss among Indigenous people

Patterns and rates of OM and hearing loss present differently in Indigenous and non-Indigenous people, resulting in more serious consequences and necessitating different support and services for the Indigenous population (for further details about the differences between Indigenous and non-Indigenous OM and hearing loss, see the Ear*InfoNet* Review of ear health and hearing and [4]). Lack of awareness within the mainstream health and education sectors of the Indigenous ear health and hearing profile being different is likely to have contributed to limited understanding and implementation of existing knowledge, and influenced the development of appropriate policy and practice in the Indigenous context.

Studies conducted in rural and remote Aboriginal communities report that OM often occurs in infants within weeks of birth [6, 7], and repeated episodes frequently lead to chronic disease that persists into adolescence and adulthood [2, 8]. It has been estimated that an Indigenous child experiences combined episodes of OM that total about two-and-a-half years, compared with three months for a non-Indigenous child [9].

There is some uncertainty about the degree of hearing impairment associated with different forms of OM [2, 10], but it is generally agreed that children presenting with perforated eardrums, particularly those with bilateral chronic suppurative otitis media (CSOM), experience the greatest hearing loss [1, 10]. Evidence suggests that half of all children with bilateral CSOM experience a loss of more than 35 dB, and very few escape without some residual loss [3]. In children, a hearing loss of 31 dB or more in the better ear is considered disabling, but even a loss of 20 dB may have negative social consequences and a significant impact during critical periods of development [2]. General guidelines for audiological practice with Indigenous Australians [5] note that even a hearing loss between 16 and 25 dB is educationally important. For further information about the categorisation of hearing loss, see the Ear*InfoNet* Background information: testing for hearing loss.

The consequences of different degrees of early hearing loss on subsequent childhood and adult development are not fully understood, but current evidence suggests that the early onset of chronic or recurrent OM, particularly in the first two years of life, leads to hearing loss at a critical period of child development [2]. Hearing loss in early childhood affects speech and language development, and learning, and may have serious and ongoing developmental and educational effects [2, 11, 12]. Educational consequences of hearing loss include delays in language comprehension and production, poor listening skills, problems with attention, distraction and memory, reduced mathematical skills, and reduced scores on intelligence tests [13-17].

Hearing loss may also contribute to poor social and emotional wellbeing, behavioural problems, and poor social skills [9, 15], and can have long-term, negative social impacts, including: limited employment options; increased risk of anti-social behaviour [18-20], drug use [21], and contact with the criminal justice system [2, 22, 23].

Persistent high levels of OM and related hearing loss reflect limited progress in treating ear disease [24] cited in [9] and highlight the need to understand and address the social consequences of OM and hearing loss [9]. People undertaking work and research in this area have called for more formal research into the social, emotional, family, educational and community effects of hearing loss [9]. The following sections draw on available literature to outline levels of OM and hearing loss in the Indigenous population, and discuss the educational and social implications of hearing loss.

Levels of otitis media and hearing loss

OM is responsible for much of the hearing loss experienced by Indigenous people of all ages [2, 8]. Levels of OM and hearing loss vary across Indigenous communities throughout Australia, but are significantly worse than those reported in non-Indigenous communities. The true extent of the problem remains unclear, but research studies, large-scale surveys, and hospitalisation data discussed below provide insights into levels of OM and hearing loss within the Indigenous population.

It is beyond the scope of this review to consider changes in levels of Indigenous OM and hearing loss over time, but findings from research studies conducted in the last two decades highlight the endemic nature of ear disease and hearing loss in Indigenous communities, and recent surveys and hospitalisation data point to the continued burden of ear disease and hearing loss experienced by Indigenous Australians.

Otitis media

Taking account of all its forms, prevalence rates of otitis media have been reported to be as high as 70% in some Indigenous communities, compared with only 5% in less disadvantaged communities around the world [25] cited in [26].

The World Health Organization (WHO) is particularly concerned about CSOM, which it considers to be a massive public health problem requiring urgent attention if it occurs in more than 4% of the population [27]. The level of CSOM among Indigenous infants, children, adolescents and even adults in many communities is far greater than this, with prevalences of up to 40% reported for some communities [8].

Improvements in ear health have been reported in some urban Indigenous communities, but very high rates of OM continue to occur in many rural and remote communities [2, 3], and rates of suppurative OM and associated hearing loss continue to be of particular concern.

For further information regarding rates of OM, see the Ear*InfoNet*'s Review of ear health and hearing.

Hearing loss

It has been estimated that 30% to 80% of Indigenous children of school age suffer from some hearing loss, and by adulthood hearing loss can be present in up to 70% of Aboriginal people [23].

Much of what is known about ear disease and resultant hearing loss in the Indigenous population has been obtained from research studies conducted in previous decades. Methodological limitations require that care be exercised when comparing such research results, but it is apparent that the level of OM and subsequent hearing loss in many Indigenous communities has been of concern for many years [28].

Different rates of hearing loss have been reported within rural, remote and urban Indigenous communities, but the Indigenous population consistently bears a greater burden of hearing loss than does the non-Indigenous population [2]. Particularly high rates of hearing loss have been documented among Aboriginal infants and children in rural and remote areas, and studies report that it often commences soon after birth. A longitudinal study of OM in Aboriginal infants identified mild conductive hearing loss within 2 months of birth [6, 29].

Research studies of Indigenous schoolchildren in remote communities found prevalence rates of hearing loss ranging from 35% to 75%, with the majority of childhood hearing impairment ranging from mild to moderate loss or worse [30]. Other studies have reported different levels of hearing loss for different forms of

OM [10]. Studies of Indigenous students at urban schools revealed varying levels of hearing loss, but did not find the very high prevalence rates found in rural and remote communities [31, 32, 12].

Higher rates of moderate or severe hearing loss have also been found among Indigenous adults in remote communities compared with those in urban communities [12]. Other studies have reported that many Aboriginal adults studying or working in urban areas suffer from slight or mild hearing loss [33, 34].

Recent surveys and hospitalisation data

In a recent survey of Indigenous children living in remote communities in northern and central Australia, nearly all children (91%) aged 6-30 months were diagnosed with some form of OM [24]. The degree of associated hearing loss was not determined.

In the 2004-05 National Health Survey, Indigenous people in age groups between 0 and 54 years reported more ear and hearing problems than did non-Indigenous people in the same age groups [35]. The survey found that 10% of young Indigenous people aged 0-14 years, and 8% aged 15-24 years had ear and hearing problems, compared with 3% of non-Indigenous people aged 0-14 years and 4% aged 15-24 years. The extent of ear and hearing problems among both Indigenous and non-Indigenous people increased with increasing age. Only among those aged 55 years and over, did non-Indigenous people report slightly more ear and hearing problems than Indigenous people (30% compared with 27%).

In the Western Australian Aboriginal Child Health Survey, undertaken in 2001 and 2002, caregivers reported high levels of ear disease among young Indigenous people with 20% of Indigenous people aged 0-11 years, and 14% aged 12-17 years having recurring ear infections [17]. Among those aged 4-17 years, caregivers reported that 7% were deaf or partially unable to hear in one or both ears.

On the other hand, hospitalisation for ear and hearing problems is reported to occur at similar levels for Indigenous and non-Indigenous people Australia-wide [36]. Hospitalisation figures may be influenced by issues associated with the management of OM and hearing loss (for further information see the section below: Prevention and management of OM and hearing loss), but higher figures for tympanoplasty - a surgical procedure to repair a perforated eardrum – reflect the greater rates of chronic OM and perforations of the eardrum experienced by Indigenous people. In WA and the NT between 2002-03 and 2003-04, Indigenous children were 14 and 8 times more likely to be hospitalised for tympanoplasty and otitis media than were non-Indigenous children [37].

Educational and social implications of hearing loss

Research studies, large-scale surveys and hospitalisation figures confirm that Indigenous people experience disproportionately high levels of OM and hearing loss. This has significant educational and social implications for Indigenous children and adults, influencing the development of language, communication, learning and social skills.

Impact of hearing loss on language development

Indigenous children frequently experience OM-related hearing loss soon after birth and it may persist throughout childhood with significant implications for the development of language and communication skills and subsequent school performance [14].

The degree and impact of hearing loss associated with OM varies according to the severity and frequency of episodes of OM, but research suggests that three or more episodes of OM before the age of three years may seriously affect language development [38]. The conductive hearing loss experienced by children frequently fluctuates: as a result, they may hear normally at times, but not at others. Under these conditions, they receive variable language input [39], hearing different forms of the same word at different times, for example. This poses difficulties for children as they try to develop language learning strategies, leading to fatigue, frustration, and frequently withdrawal from interaction [40].

It is generally accepted that children who experience multiple episodes of OM- related hearing loss prior to going to school experience difficulties with the development of auditory discrimination and processing skills, phonological awareness, short-term auditory memory skills, and auditory sequential memory skills [20, 41, 42]. Ultimately, this affects a child's ability to learn to communicate and read and write, and contributes to poor educational outcomes [40, 43].

Impact of hearing loss on education

Research conducted by NACCHO (the National Aboriginal Community Controlled Health Organisation) has shown that Indigenous children with CSOM attend school less frequently than other children [44]. Research over many years has also demonstrated that Indigenous students have poorer educational outcomes than the wider student population [45]. Comprehensive quantitative evidence demonstrating the effects of hearing loss on Indigenous educational outcomes is lacking [46], but research clearly suggests that hearing loss associated with both CSOM [25] cited in [26] and OME [39] affects the school performance of Indigenous students.

Learning within the school environment relies on language and communication skills, and children who have experienced hearing loss in early life are likely to struggle with most aspects of schooling [40]. Children who have difficulty performing tasks that require literacy and numeracy skills may become disinterested in learning and attend school less regularly. Consequently, they are less familiar with classroom routines and less able to interpret and participate in classroom activities when they do attend school. Ultimately, hearing loss may lead to school failure, absenteeism, early school dropout, and reduced employment opportunities [14].

The negative effect of hearing loss on language acquisition, and subsequent reading, writing and learning, is likely to be magnified by a range of issues that impact on the educational experiences and outcomes of Indigenous students. Many Indigenous students have difficulties adjusting to a classroom where the language and environment differ from that of their home environment [2, 14, 47]. Many Indigenous students speak a language other than English at home, or they speak a dialect of English (Aboriginal English). As a result, they may not be familiar with the sounds and structures of Standard Australian English (SAE) spoken at school [48, 49]. Language, literacy and learning difficulties may be compounded by poor school attendance associated with cultural events and family commitments, such as ceremonies and funerals. In addition, literacy learning resources (books, magazines and word games) are frequently lacking in Indigenous families [14], and there are often issues of power and identity associated with language use [20]. Issues of racism, oppression, alienation, and poverty also influence the learning of Indigenous students [45].

While the factors referred to above may compound the poor educational performance associated with hearing loss, they, and various cultural differences [50, 21], may also 'mask' hearing loss as a cause of poor educational performance. Hearing loss may also be overlooked as an underlying cause of poor educational performance in children who are quiet and introverted, or who alternatively "act-out" and exhibit behaviours that they have developed as a response to their hearing loss [45, 51, 52]. These characteristics do not only apply to hearing impaired children, but, when they are observed in students, teachers should consider whether they may be indicative of hearing loss.

Impact of hearing loss on social skills

Hearing loss effects not only educational performance, but also social and emotional wellbeing and social interaction, and can lead to behavioural problems (such as irritability, disobedience, distractibility, and overactivity), which, in turn, can lead to social isolation [41]. At school, children may be ostracised by their peers, and the educational and social problems they experience may lead them to leave school early [14].

Many Indigenous children with hearing loss will also have behaviour problems at home that may damage both the child's and the carer's social and emotional wellbeing, disrupt family life, and impact on community functioning [9].

Poor social and emotional wellbeing, behaviour, and social skills add to the range of disadvantages experienced by many Indigenous people, and can have long term, negative social impacts, including limited employment options, increased risk of anti-social behaviour [18-20] and drug use [21] and increased risk of contact with the criminal justice system [2, 22, 23].

Factors contributing to hearing loss among Indigenous people

The extent of hearing loss in Indigenous communities is determined largely by levels of OM [2, 8], so factors that contribute to high rates of OM will contribute to high rates of hearing loss.

The definitive cause of OM among Indigenous peoples remains unclear, but evidence suggests that it is associated with chronic respiratory infection, caused by bacteria, that originates in the nose and spreads to the middle ear [3]. For further information about the cause of OM see the Ear*InfoNet* Review of ear health and hearing.

Factors that contribute to OM and increase the risk of hearing loss include: premature birth, being male, not being breastfed, exposure to smoke from cigarettes or wood fires, poor nutrition, poor hygiene, lack of access to clean water, lack of access to medical services, overcrowded living conditions, and environmental conditions [12, 53, 54].

Environmental conditions are important determinants of levels of OM and subsequent hearing loss in Indigenous communities. Many rural and remote communities have poor housing with inadequate access to water, sewerage systems, and waste removal [55]. These living conditions and overcrowding contribute to poor hygiene, increase the risk of infectious ear disease [2, 8, 56], and contribute to the early onset of chronic or recurrent OM, placing Indigenous infants at increased risk of early conductive hearing loss [29]. The risk of hearing loss is heightened by the fact that symptoms of OM are often lacking, atypical, or so short-lived in Indigenous infants that they are rarely recognised by health staff [56].

Environmental risk factors, coupled with inadequate health-related infrastructure and health services [57], ineffective treatment [58], and poor nutrition and exposure to passive smoking [28, 56, 57, 59], reflect the profound socioeconomic disadvantages faced by many Indigenous communities. Like many health problems, the prevention and management of OM and hearing loss in Indigenous

communities requires a comprehensive approach that combines medical, social and economic interventions, including education strategies to combat OM-related hearing loss and its lifelong consequences for Indigenous peoples.

Prevention and management of otitis media and hearing loss

OM and related hearing loss have significant educational and social implications. Their prevention and management depends on:

- social, economic and environmental strategies to prevent OM;
- medical and surgical interventions to treat OM and improve hearing;
- rehabilitation services to address hearing loss; and
- strategies to address the educational and social consequences of hearing loss.

The following discussion outlines a range of issues involved in the prevention and management of OM and hearing loss, including: primary prevention strategies; screening; diagnosis; treatment; and rehabilitation. Information about OM is provided where relevant, but for further details about the medical management of OM, see the Ear*InfoNet* Review of ear health and hearing.

The prevention of OM and hearing loss

Issues such as poor housing, overcrowding, and limited access to nutritious food underlie many Indigenous health problems. Addressing these issues will be necessary to reduce the levels of OM and subsequent hearing loss, and improve Indigenous health and wellbeing more generally. Other preventive measures to specifically address OM include strategies to: improve personal hygiene; encourage breastfeeding; encourage swimming (where possible): ensure appropriate vaccination; and discourage smoking [11, 60, 61].

Preventive strategies such as these will need to be accompanied by interventions to improve the early detection and management of OM and hearing loss in Indigenous communities.

The management of OM and hearing loss

Separate clinical guidelines and audiological guidelines have been developed to assist the management of OM and hearing loss in Indigenous people.

In 1997, the Australian Government's Office for Aboriginal and Torres Strait Islander Health supported the development of a systematic review of evidence and clinical guidelines related to the management of OM in Indigenous populations [62]. In March 2001, Recommendations for clinical care guidelines on the management of otitis media in Aboriginal and Torres Strait Islander populations was released [60]. The recommendations were based on the findings of the systematic review (for further information see the Ear*InfoNet* Review of ear health and hearing).

These clinical guidelines were followed in June 2001 by the release of more general audiological guidelines developed to ensure a coordinated and uniform approach to Indigenous audiological management. The General guidelines for audiological practice with Indigenous Australians: information to assist audiologists in the delivery of comprehensive, effective and appropriate audiological management for Indigenous clients/patients were developed by the Audiological Society of Australia to improve the multi-disciplinary management of hearing loss [5]. The Society considers them relevant to audiologists and related service providers, including speech pathologists, Indigenous health workers, community GPs and district medical officers. As little evidence from audiological research exists, and no systematic reviews of the available literature have been undertaken, the guidelines represent 'preferred practice' derived from expert opinion, rather than 'best practice' [63].

The audiological guidelines are designed to inform and support the delivery of hearing services to Indigenous Australians in urban, rural and remote areas [5]. They outline a range of practical considerations for service providers, including cultural, logistical, professional, and personal support issues, which need to be addressed to provide effective, high quality services.

Services for the clinical management of OM among Indigenous people are provided and/or funded by a range of State/Territory and Commonwealth agencies through a mixture of community health and public hospital services, together with Medicare-funded general practitioner and specialist services. Similarly, services to address hearing loss are primarily provided through a mix of Commonwealth and State/Territory government programs [64].

Screening

Screening is an important first step in the provision of appropriate medical, surgical, audiological and educational services [65]. The early detection of otitis media and hearing loss in Indigenous children is recommended [1]. Two forms of screening provide early identification of OM and hearing loss in Indigenous populations: opportunistic screening for OM; and screening for hearing impairment [2].

The arguments for and against screening for OM are beyond the scope of this review but support for screening of this type rests on early detection of ear disease to enable appropriate antibiotic treatment and/or prophylaxis [2]. Screening for hearing loss is

included as an element of the 'well person's health check' (WPHC) for Aboriginal and Torres Strait Islander children. The term WPHC refers to preventive health assessments that include targeted or regular screening processes to evaluate the risks for chronic disease among Aboriginal and Torres Strait Islander adults and children. The inclusion of screening for hearing loss in the child WPHC reflects the major public health problems posed by ear infections and hearing loss in Indigenous communities [66].

Given the high levels of OM, it is accepted that Indigenous children should be screened regularly for hearing impairment in order to appropriately target those in need of medical, surgical, rehabilitative and educational services [2, 5]. The schedule for the child WPHC recommends hearing evaluations at 2, 4, 6, 12, 18 and 24 months, and between 3 and 5 years of age (prior to school-entry) for children at high risk [66].

Screening in the neonatal period for infants at high risk of sensorineural hearing loss is currently widely implemented. Screening for hearing impairment in Indigenous pre-school children is strongly supported, and hearing screening for children when they commence their first year of schooling has also been recommended [2, 5]. Research from Queensland suggests that school access to hearing screening, screening follow-up, and ear health programs is influenced by:

- the school's knowledge of the screening service;
- relationships developed between local health and education service providers;
- Indigenous community perceptions of hearing loss and disability;
- health sector funding and the priority given to ear health by health organisations;
- health staff turnover, training and access to equipment;
- health policy regarding access to results; and
- the establishment of clinics and hospitals in communities [65].

The audiological guidelines for Indigenous people outline preferred practice when screening for ear disease and hearing loss in various age groups [5]. They make specific recommendations regarding screening for hearing loss in children under three years, preschool and school aged children, and adults. They consider the suitability of screening tests in the various age groups and make recommendations regarding the appropriate use of:

- tympanometry;
- otoscopy;
- oto-acoustic emissions;
- auditory brain stem response (ABR) audiometry;
- checklists and behavioural tests;
- pure tone audiometry; and
- speech discrimination tests [5].

The guidelines recommend that screening results are fed back to parents and relevant organisations, such as schools, and that information is provided on ways to help children while they are waiting for a formal diagnosis to confirm the findings of a positive screening test [5].

Diagnosis

The audiological guidelines highlight the need for audiometric follow-up for diagnosis of ear disease and hearing loss [5]. They emphasise that the results of hearing screening are only an indication of hearing loss. A failed hearing test does not mean that a child has hearing loss, and a passed hearing test does not mean that a child has normal hearing. In line with their approach to screening, the guidelines make specific recommendations for the diagnosis of hearing loss in children under three years, preschool and school aged children, and adults. Recommendations address the use of:

- behavioural assessments;
- tympanometry and otoscopy; and
- oto-acoustic emission tests, auditory brain stem response (ABR) audiometry, and steady state evoked potentials (SSEP) [5].

The recommendations highlight the need to refer children with diagnosed hearing loss to appropriate service providers for treatment and rehabilitation (for example, Australian Hearing, medical practitioners, medical specialists, clinics, the child's educational institution, and the State/Territory education departments). They recommend that adults also be referred to relevant agencies including those that deliver the Commonwealth Hearing Services Program, the Commonwealth Rehabilitation Service (for adults who require assistance within the workplace), or local hearing-aid bank schemes [5].

Treatment

Once OM has been diagnosed, appropriate treatment may lead to improved clinical and hearing outcomes. The clinical care guidelines for OM in Indigenous populations outline appropriate medical and surgical interventions for the various forms of OM [60]. (For further information see the Ear*InfoNet* Review of ear health and hearing.)

Surgical interventions are considered if medical treatment (including the judicious use of antibiotics) has failed, hearing is impaired, and/or there is a risk of further damage to the ear [2, 8, 67]. Evidence suggests that the surgical needs of Indigenous communities are not being met by current service provision [2], and

that surgical outcomes in remote Indigenous communities may be limited due to difficulties associated with climate, vast distances, poor hygiene, poor nutrition and general health, problems with treatment compliance, and the reduced socio-economic and educational status of community members [68] cited in [67].

Issues regarding the appropriateness of surgical interventions are beyond the scope of this review, but researchers have cautioned against unnecessary surgery and have questioned its impact on learning and education if it is not initiated during the critical years of early childhood development [2].

Rehabilitation

People with persistent hearing impairment despite appropriate medical or surgical treatment should be referred to rehabilitation services that can assist hearing and the development of language/communication skills [2]. Referral will depend on the age of the individual but may require coordination between various service providers, including Australian Hearing, resident audiologists, speech therapists, the child's educational institution, the State/Territory education department, teacher aides, and other hearing rehabilitation services that specialise in communication strategies.

Strategies needed for rehabilitation may vary considerably and should address local considerations, including cultural issues and geographical isolation [69]. Broadly, audiological rehabilitation for hearing loss will require education about language/communication issues and appropriate use of amplification devices to assist hearing [8].

Language/communication issues among children

The audiological guidelines for Indigenous people make specific recommendations regarding rehabilitation for children under three years, preschool and school aged children, and adults [5]. They recommend that parents/caregivers of children under 3 years receive instruction regarding appropriate listening strategies and hearing tactics. They should also be encouraged to involve their children in play groups and other relevant activities to promote language stimulation and develop pre-literacy skills. In preschool and school-aged children, rehabilitation strategies need to encourage parents/caregivers to provide a positive early literacy learning environment in the home and to participate in school activities. Parents/caregivers should also be made aware of the availability of free hearing services (including hearing aids).

The hearing loss detected in screening programs for Indigenous children suggests that they will suffer more than their normal-hearing peers from difficulties caused by reverberation, noise and distance from the teacher [69]. School-based strategies should raise awareness among staff regarding daily treatment requirements for discharging ears, availability of health services, education and communication strategies, and interventions to improve the classroom listening environment. Amplification options may include classroom devices (such as sound field amplification systems) and assistive listening devices (for example, FM systems - a form of personal amplification that transmits an FM signal from a microphone worn by the teacher to a receiver worn by a child with hearing loss) [8]; and individual fittings for air conduction or bone conduction hearing aids. Children with an educationally significant hearing loss should be referred to specialist educators (such as teachers of the deaf), and those with oral language delay or disorder should be referred to a speech pathologist [5]. For further information about school-based strategies see the section below: Education strategies addressing hearing loss among Indigenous people.

Language/communication issues among adults

Rehabilitation strategies for adults need to consider cultural issues (for example, lip-reading may be problematic if eye contact is not culturally appropriate) [5]. Post-secondary students should be informed of available hearing services and amplification devices to assist their studies; and individuals encountering the criminal justice system should be assisted to access available services. Local police and justice personnel need to be aware of the implications of hearing loss for people in the justice system, and the availability of hearing services.

It is also appropriate to have a communication plan for use when communicating in English with hearing-impaired Indigenous adults residing in remote communities about unfamiliar topics [70]. Communication difficulties for these adults will be greatest when usual routines are altered and when unfamiliar non-Indigenous people are talking about issues from a different cultural perspective. A communication plan will help hearing impaired community members to understand what is proposed during any process of change, and will give them an opportunity to contribute to discussions. An appropriate communication plan needs to consider:

- that Indigenous people with hearing loss may be easily 'shamed' by problems that arise as a result of their communication difficulties;
- limiting background noise and/or conducting meetings in quieter venues;
- using visuals, such as flip charts, pamphlets and DVDs, as an aid to communication;
- enabling people with a hearing loss to observe what others do before asking them to participate in an activity;
- allowing time for discussion breaks during meetings so that information can be relayed to those who may not have fully understood what was said;

- giving people time to discuss and understand the issues before expecting a response;
- using appropriate interpreters (people with more severe forms of hearing loss may only be able to communicate effectively through family members who know them well);
- using culturally appropriate communication protocols; and
- using amplification equipment to aid communication in group situations [70].

Adults should be made aware of public address systems and/or other listening devices that may be relevant for use at community meetings [5]. Such amplification equipment is a component of communication planning and may minimise anxiety and frustration experienced by adults with mild to moderate hearing loss [70].

Amplification devices

Indigenous people of all ages should be aware that they may be eligible to receive amplification devices through the Australian Government Hearing Services Program. This program provides free hearing rehabilitation services for children and eligible adults, including the supply and fitting of hearing aids [2]. For further information about the program see the following section: Services provided by Australian Hearing.

Fitting hearing aids for Indigenous children is complicated by our limited understanding of the short-term hearing fluctuations that are often associated with perforation and discharge [10]. The use of traditional hearing aids with ear moulds is not satisfactory when discharge is present. Under these circumstances, a bone-conduction hearing aid is generally more appropriate [71] but its aesthetic acceptability has been questioned [72]. Finding a culturally acceptable form of personal amplification for Indigenous children may be difficult [10, 73], and children, parents and Indigenous health workers will require counselling to ensure the successful use of hearing devices. Practical issues such as the reliability of devices and the availability of batteries in remote areas also need to be considered [2].

If adults are not eligible for hearing aids through the Australian Government Hearing Services Program, they will need to be advised of eligibility criteria for hearing aids available through the Commonwealth Rehabilitation Service (if personal amplification is required at work); hearing-aid banks, subsidised hearing-aid programs; or private audiological services [5].

Services provided by Australian Hearing

The Australian Government Hearing Services Program is the major source of free hearing rehabilitation services for children and eligible adults, including hearing assessment; supply and fitting of hearing aids; advice on the management of hearing loss; and additional specialist services as required. The program is administered by the Office of Hearing Services within the Australian Government Department of Health and Ageing and funds are allocated to Australian Hearing for the delivery of services to meet the needs of special groups (for further information see the Department of Health and Ageing website). The special groups include children and youth up to the age of 21, Indigenous adults over 50 or participating in the Community Development Employment Projects (CDEP) Program, and those undergoing vocational rehabilitation with the Commonwealth Rehabilitation Service [64, 74, 75].

Services delivered by Australian Hearing include:

- hearing tests;
- special support for babies and children;
- programs for schools where many children have hearing problems;
- information about help available in the community;
- ear health meetings and workshops with community representatives; and
- ear healthcare training for community health workers [76].

Australian Hearing runs workshops with educators to increase awareness of the difficulties caused by hearing loss, encourage referral when hearing loss is suspected, and provide information to help teachers work with hearing impaired students in the classroom [76]. It has also created a 'hearing hat' (a bone conductor aid enclosed inside the lining of a baseball cap) to address children's reluctance to wear personal amplification devices, and developed a sound field amplification unit for installation in schools. The SASIE radio frequency system has been specifically designed by Australian Hearing for use in both remote communities (where audiological and technical assistance is often not available) and urban communities. The system includes four speakers, a receiver/amplifier and two transmitters for use in dual teaching classrooms. The teacher's voice is transmitted via FM sound wave and broadcast through speakers placed on the walls of the classroom at a level that can be heard by all of the children in the classroom no matter where they are sitting [69].

Indigenous people can access Australian Hearing's services through mainstream hearing centres or through its outreach program called Australian Hearing's Specialist Program for Indigenous Australians (AHSPIA) [69, 76]. The outreach program was developed to provide a more flexible and culturally sensitive model of service delivery to Indigenous people. It includes the provision of hearing rehabilitation services together with community education on the prevention and management of hearing loss [64]. Outreach services are provided through Indigenous community-controlled health services, other health services used by Indigenous clients,

or schools with a high proportion of Indigenous students. The number of visits made to each site each year varies and is subject to negotiation. Logistical and physical difficulties may limit service delivery in remote areas and visits may occur only a couple of times each year. Services are provided by a national team of specialist audiologists and guided by specific standards and protocols, namely Protocols for hearing services provided to Aboriginal and Torres Strait Islander clients by Australian Hearing (Australian Hearing, 2004 cited in [69]) and Clinical standards for Indigenous services (Australian Hearing, 2000 cited in [69]). These documents outline what services are provided and how to deliver them in a culturally appropriate manner. Wherever possible, services are planned, developed and delivered in collaboration with Indigenous health workers and other relevant Indigenous community members. In 2004, around 129 outreach sites were located in urban, rural and remote areas across the country [69].

Review of the Australian Government Hearing Services Program

In 2000, the Office of Hearing Services and the Office for Aboriginal and Torres Strait Islander Health (within the Australian Government Department of Health and Ageing) commissioned a review of Commonwealth-funded ear health and hearing services for Indigenous people [64]. The review assessed the extent to which the ear health and hearing needs of Indigenous people were being met by the Australian Government Hearing Services Program and other major Australian Government strategies.

The review found that the Australian Government Hearing Services Program had made a significant contribution to addressing ear health and hearing among Indigenous people, but noted that:

- funding was inadequate to meet the very high burden of ear disease and hearing loss in the population;
- the use of hearing aids (which are frequently not appropriate for conductive hearing loss) was not an optimal rehabilitation strategy for addressing the pattern of hearing loss typically found in Indigenous populations; and
- access to specialist services was limited in rural and remote areas [64].

The review recommended intensified and more strategic investment to reduce current and future levels of hearing loss [64].

Among its other findings, the review identified an unmet need for hearing devices, particularly among adults [64]. The review also found that the absence of funding for sound-field amplification systems (SFAS) had led to significant differences in the uptake of this equipment between jurisdictions and schools. The installation and use of SFAS has typically been driven by a committed individual and dependent on the goodwill and interest of the school principal or classroom teacher. Ensuring adequate maintenance by staff and technicians often poses problems, particularly in rural and remote areas, and use of the equipment frequently ceases when changes in personnel occur [64].

In 2001, the National Aboriginal Community Controlled Health Organisation (NACCHO) responded to the final report of the Hearing Services Program review and outlined ten key points that focused on findings from the review and raised other neglected issues [77]. Among its key points, NACCHO highlighted that:

- very few Indigenous adults applied for services available to pensioners, persons on sickness allowance, and Defence personnel (100 Indigenous adults in 2000 compared with 130,000 adults accessing the program overall);
- few Indigenous people accessed the program's Hearing Centres, most of which were located in urban areas, and additional services offered through Aboriginal Community Controlled Health Services were insufficient to meet demand;
- Indigenous children received only 5% of services for all children despite their much higher rates of hearing loss.

NACCHO considered that the unmet demand for Indigenous hearing health services was significant and that there was an urgent need to redevelop the program to meet Indigenous hearing health needs. It was recommended that eligibility criteria be changed and services delivered in culturally appropriate primary health care settings, such as Aboriginal Community Controlled Health Services, to improve Indigenous access to the program.

Access to specialist services

NACCHO found that the delivery of hearing services to rural and remote Indigenous communities was insufficient to meet demand [77] and the review identified geographical distance and isolation as major impediments to Indigenous access to specialist services [64]. It was found that remote communities lacked regular access to hearing tests, follow-up visits, and maintenance services for hearing aids. (As they do to the whole range of specialist health, education and social services necessary to address hearing loss [5].) Identified among the practical difficulties and costs associated with providing services in these areas were:

- the lack of appropriate health service infrastructure;
- the expense of long distance travel for both clients and providers; and
- the lack of appropriately skilled staff [64].

Factors found to affect access to services provided by ear, nose and throat (ENT) specialists and audiologists included:

- an overall shortage of specialists in rural and remote areas;
- the cost of providing services in rural and remote areas, and the lack of resources;

- the complicated logistics involved in coordinating outreach teams and delivering services;
- the frequently limited availability of appropriate after care and follow-up support;
- the cost to individuals, and their availability to attend services when they are delivered; and
- the limitations associated with eligibility to the Commonwealth Hearing Services Program [64].

It has been suggested that the access and utilisation of specialist services by Indigenous people should be reviewed to determine the extent to which ear health needs can be met now and in the future [2]. To do this, professional bodies would need to develop measures to assess the adequacy of access of rural and remote communities to specialist services.

Referral processes, such as the way appointments are made and notified, also need to be optimised [2]. The development of a register for Indigenous people with hearing loss could contribute to improved referral processes and coordinated care. Computerised registers would assist primary health care services to organise specialist and rehabilitative service referrals, and to facilitate follow-up. Special studies would be needed to define the optimal characteristics of such a register and to evaluate its utility.

Efforts to determine the extent of access to services and to improve referral processes would need to be complemented by service delivery that promotes utilisation [69]. Community-based hearing services would be utilised if they met community needs and were perceived to be of value to the community. Providing community education [69], encouraging participation [65] and collaboration [69], and building capacity are considered critical to the development of successful and sustainable hearing health services and broader hearing health programs [63]. However, clear processes to ensure community participation have not been determined [65], and building community capacity is considered one of the most difficult aspects of service and program delivery [5].

Hearing health programs

Despite the difficulties involved in engaging communities and building capacity, experience has shown that successful hearing health programs can be developed when there is community knowledge of the importance of good ear health [69]. A comparison of separate studies of the hearing health of Cherbourg schoolchildren conducted in 1972 and in 2000 found significant improvements in hearing status [78]. It was suggested that improvements over the three decades could be attributed to many factors, including increased awareness of ear health, and the introduction of a hearing health program.

To develop community awareness, participation and collaboration, children, parents, teachers and the community at large need to understand the important role that hearing plays in maintaining a healthy lifestyle and the difficulties that are faced by those with hearing loss [69]. In some communities, responsibility for aspects of a child's care (for example, treatment) may not lie with the parents, so awareness campaigns must target the entire community to ensure that other caregivers are reached [79].

Successful hearing health programs also need to adopt a team-work approach [69]. It is essential that health and education agencies work closely together and in partnership with communities to ensure effective coordination of medical, audiological, and educational services [5, 69].

Developing community awareness and participation needs to be combined with other key components of hearing health programs, such as:

- Prevention, including use of preventive strategies at home and school, promoting nasal clearing and nutrition, and lobbying for improved sanitation and environmental health services.
- Screening and assessment, including use of appropriate screening tests in different contexts (for example, audiometry, personal health records and checklists for symptom recognition), and full assessment of audiological, medical and educational needs.
- Treatment and referral, including appropriate treatment, compliance, and follow-up care, and referral to appropriate medical, audiological, and educational interventions.
- Monitoring, review and follow-up to periodically check for the development of OM/CHL in children.
- Educational support to assess the development of speech and language in children, create good listening environments to provide language, speech and literacy activities that accommodate hearing loss and address its consequences, and provide communication strategies for adults [5, 80].

The importance of educational support within hearing health programs

The wide-ranging social, emotional and educational consequences of hearing loss have significant implications for the role of schools in the delivery of hearing health programs. Teachers need to be supported to develop a range of strategies to identify and manage hearing loss within the classroom [81].

Health strategies used within schools to help prevent and combat the effects of ear disease among Indigenous people include regular health screenings, ear examinations [82] cited in [26], and the BBC (breath, blow, cough) program (a common health practice that encourages students to breathe deeply, blow their noses, and

cough to clear their nasal passages and Eustachian tubes each day) [45].

The impact of educational strategies on subsequent student outcomes would be determined by various factors. The findings of a Queensland review of services for Indigenous students with conductive hearing loss identified a range of factors that have implications for the delivery of educational support and subsequent student outcomes, including:

- teacher knowledge of cross-cultural pedagogy, English as a second (or additional) language (ESL/EAL) pedagogy, and special education principles;
- teacher training and professional development to provide the knowledge and skills necessary to support students with hearing loss; and
- a whole-of-school response that combines supportive school environments, appropriate school based programs and specialist teaching support for hearing impaired students [65].

To ensure the development of appropriate educational strategies, schools need to establish effective working partnerships with agencies and communities [65]. Teachers may need to work with educational consultants, liaison officers, and health workers, and consult with parents/caregivers and community members (such as grandmothers, elders, etc.). Successful consultation with Indigenous communities is critical and advice should be sought regarding the correct procedures for consulting and working with local communities. Indigenous teaching staff are important sources of information and advice, and provide critical support for Indigenous children with hearing loss. If such staff are not available, schools should seek to involve relevant community organisations and members [83]

Teachers who work specifically with hearing impaired children are also a critical source of specialist support [83]. They can assist schools in developing teaching strategies and resources for hearing impaired children. Together with Indigenous teaching staff, they have an important role in providing education for teachers, parents, communities and health workers regarding the educational implications of OM and hearing loss.

Around the country, a number of education departments have also produced professional development packages about OM and conductive hearing loss [81], for example, the Western Australian Education Department's Do you hear what I hear? [84] or Education Queensland's Otitis media: Hearing loss and teaching [85]. They provide information about identifying students with OM and/or hearing loss, and suggest education strategies to overcome some of the associated problems.

The following discussion outlines some of the strategies and interventions that are recommended to address the educational consequences of hearing loss.

Education strategies addressing hearing loss among Indigenous people

Improvements in educational outcomes are key to improving the health and wellbeing of Indigenous people and will contribute to improved employment prospects, income, standard of housing, and access to health care [86]. The educational participation, performance and attainment of Indigenous people is slowly increasing, but remains below that of other Australians. This is due in part to the disproportionate levels of OM, hearing loss, and other chronic health problems that negatively affect the school attendance and learning outcomes of Indigenous students [26].

Appropriate educational interventions are necessary to help improve the literacy and school performance of Indigenous students with hearing loss. Interventions will need to address issues associated with current hearing loss and/or remaining language difficulties associated with past hearing loss [14, 40, 45].

A range of interventions that may enhance listening and learning are discussed below. They include strategies that focus on:

- identifying hearing problems;
- implementing appropriate classroom management strategies;
- developing the language skills that underlie written literacy;
- using a variety of teaching methods; and
- increasing student awareness of hearing problems.

Developing working partnerships with Indigenous teaching assistants and community-school liaison people will ensure that interventions are culturally appropriate, and consulting staff who specialise in teaching hearing impaired students may lead to other useful resources [13, 21, 40, 87-90].

Identifying hearing problems in the classroom

Teachers vary in their awareness of the possibility that some of their students may have hearing problems [40]. Some are not sufficiently aware, while others may be aware of the possibility but not know if anyone in their class is affected by hearing loss. Identifying hearing loss can be difficult, as some children develop strategies to mask their hearing impairment and any problems they may have coping with classroom demands. Identifying hearing loss is complicated further by its fluctuating nature [39]. Children may hear normally

at times and, as a result, be able to participate normally in the classroom, but at other times, when their hearing is impaired, they may be disengaged and withdrawn and exhibit other behaviours that can be mistaken for misconduct. Teachers, especially those working in high risk areas, such as remote locations, would be wise to assume that all children in the class might have had ear disease at some time, and consequently may have some level of hearing impairment that impacts negatively on language development [40]. Adopting teaching strategies that are helpful for students with hearing impairment will benefit all students.

Teachers should be able to find out about the hearing status of students in various ways. Following protocols that apply in their school, teachers should be able to access children's school health records to see if a history of ear disease has been recorded. Relevant records may not be available if students were absent from school when screening was conducted, and where they are available they should be interpreted with care. A child may not have had hearing loss at the time of the screening and/or may have mild hearing impairment that is not recorded because it falls within the threshold for normal hearing. Nevertheless past hearing loss or current, slight, unrecorded hearing loss may still effect language development and learning [40, 90]. Comments from parents, community members, or other children are other potential sources of information about the possible presence of hearing loss. Such anecdotal information can be followed up with classroom observation and more formal assessments.

If health records do not provide information about hearing status, and health services are not readily available to conduct an assessment, there are a range of screening tools available that may be used by the teacher to provide informal assessment of hearing status [40]. Findings from such tools must be confirmed subsequently by formal medical diagnosis. The screening tools used by teachers typically monitor physical, speech, learning, and/or behavioural indicators that suggest whether a child might have hearing loss (for examples, see [52, 91, 92]). Another tool is 'Blind man's Simon says,' a simple, informal speech reception test that has been used to assist the identification of hearing loss among Indigenous students. The teacher or an assistant gives instructions to a small group of children (that includes hearing and suspected hearing impaired students) to perform simple actions. Initially the instructions are given in a voice that all can hear, but gradually they are spoken more softly. Children with hearing problems are identified by their failure to follow and respond appropriately to instructions spoken softly [50].

Once the possibility of hearing loss has been identified, teachers can implement appropriate classroom management strategies and other educational interventions and learning programs, and follow school protocols to seek other help for the child [40]. Discussions with education and health support staff may provide further help and ideas about working with children with hearing loss, and specialised health interventions may be arranged by talking with the school nurse or health worker.

Classroom management

The hearing and listening conditions that exist in classrooms are frequently less than ideal [90, 93, 94], but teachers can assist students with hearing loss by adopting classroom management strategies that maximise listening, enhance hearing opportunities, and support learning [40, 95].Classroom management strategies include:

- modifying the classroom environment to minimise noise;
- installing classroom amplification systems to improve the listening environment;
- organising class seating arrangements for optimal hearing and listening;
- negotiating culturally appropriate classroom listening behaviours;
- developing 'buddy' systems to provide peer support for students with hearing loss;
- pre-teaching new words and concepts to facilitate subsequent class participation; and
- using routines to enable children with hearing loss to predict what will happen next [40, 84, 94].

These strategies are discussed in more detail in the following sections.

Modifying the classroom environment to minimise noise

To improve listening and learning opportunities, it is important that teachers try to minimise noise both inside and outside the classroom [40].

Noise inside the classroom may be associated with equipment, and with people talking or moving around [91, 94]. Equipment noise associated with fluorescent lights, air conditioners, fish tanks, computers and other electrical items can be minimised with regular maintenance. Noise associated with the movement of desks and chairs can be minimised by teaching children to move quietly and carefully, and by putting rubber tips on the end of desk and chair legs. Internal noise can be minimised further by installing sound absorbing materials that reduce the high levels of reverberation associated with the many hard surfaces found in classrooms. If at least 50% of the hard surfaces in a classroom are covered by soft furnishings, carpet or matting, pin-up boards and artwork displays, the listening environment can be improved significantly [95].

Noise from outside the classroom may be harder to address [40]. It may be associated with traffic, machinery, and/or the activities of other students and staff. If the external noise is permanent (for example, traffic), it may be possible to negotiate a classroom in a quieter area of the school for the part of the day when critical teaching takes place. If another classroom is not available, and negotiation with other staff or contractors fails to reduce the noise, critical teaching (for example, explicit teaching of literacy skills) should be scheduled for the quietest time of the day [95].

Installing amplification systems

Another way to improve the classroom listening environment is the use of classroom amplification. Several forms are available, and each school needs to seek professional advice about the unit that will be most appropriate to their context, and provide appropriate professional development and on-going support to school staff in using classroom amplification [96].

When FM amplification devices were introduced they were considered a 'significant breakthrough' for hearing-impaired Indigenous children [97]. These personal amplification systems are designed for children with a hearing loss greater than 30–35 dB. They consist of microphones and portable FM radios, and transmit the teacher's voice to lightweight non-occluding headphones [3].

Sound-field amplification systems (SFAS) are designed to raise the teacher's voice by 10–15 dB. They have been used in schools in which the majority of children have a hearing loss of greater than 15 dB [97]. It is particularly important to use the SFAS when explicit teaching to the whole class is in progress [40].

Organising children to maximise listening

To facilitate hearing, listening, comprehension and participation, children with hearing loss should be seated so they can readily see non-verbal cues, which will usually mean in close proximity to the speaker, who may be a teacher or another student [14, 40, 84]. When giving instructions or undertaking explicit teaching, teachers can position children in a close group (for example, seating them on a specially designated carpeted area of the classroom ('a mat session')), before sending them to work individually or in small groups. Speakers should face the listeners, wait for silence, ensure everyone is listening, and then speak clearly. It is also important that the room is well lit so that children can utilise visual cues, including lip reading [98]. Repeating (or re-phrasing) speech, giving short, sequenced instructions, and using non-verbal language will also assist students [40, 94]. There are a range of other strategies that can also be helpful in enhancing the listening environment for students with conductive hearing loss.

Negotiating listening behaviours

Teachers of students from cultural backgrounds different from theirs will need to be sensitive to different interaction styles [88] and to different listening styles [40]. In mainstream Australian classes, listening is typically demonstrated by facing the speaker, maintaining eye contact, and remaining still during an interaction. For some Indigenous people, however, maintaining eye contact may be considered disrespectful, and people may move in and out of a conversation, and still be listening. So, in such contexts, when Indigenous students are sitting still and listening carefully, it may indicate that they have hearing problems and are trying hard to pick up what is going on, as students with normal hearing would be more likely to be moving around [21].

Teachers should negotiate culturally appropriate listening behaviours with their classes [40]. Indigenous support staff and local community members can provide advice about protocols and help negotiate culturally appropriate ways for students to signal to the teacher that they are listening.

Developing 'buddy' systems

Establishing a 'buddy' system may provide additional support for children with hearing loss [40, 84]. This typically involves appointing designated students to help hearing-impaired students, according to pre-determined guidelines set by the teacher. The 'buddy' of a student with hearing loss may be responsible for making sure the student has heard instructions and knows what to do, and may be the first point of call if the student needs help.

Alternatively, older students may be taught the same material as younger ones in order to tutor them [40]. Such a system may provide a culturally relevant way to help younger children and help older students who have failed to develop essential foundational language skills due to hearing loss.

Pre-teaching new material

If children with hearing loss are not familiar with key words and concepts, it is likely that they will struggle when new material is introduced. Teachers can assist these students by pre-teaching key words and concepts ahead of introducing the material to the class [94]. This pre-teaching will provide a foundation that the students can build on, and will enable greater participation during class lessons [40]. Children's understanding of the information and concepts should be checked subsequently, and re-instruction provided if necessary.

Establishing predictable routines

Establishing and maintaining classroom routines is also critical for children with hearing loss [40]. If classroom activities are

predictable, children will be able to follow what is happening and participate appropriately, even if they have not heard all the instructions properly. This will help them to remain engaged, and will reduce the chances that they will be ostracised by their peers due to inappropriate responses.

Focusing on literacy

The early years of schooling are a particularly important time for literacy development. A longitudinal study conducted in Western Australia identified a number of characteristics associated with effective literacy learning for Indigenous students with conductive hearing loss [14]. Broadly these include an explicit focus on language development and an ability to place teaching in context and to use interaction styles that are compatible with Indigenous ways of interacting.

Developing the language skills that underlie written literacy

Focusing on the language skills that underlie written literacy can assist students with hearing loss to perform at a level consistent with mainstream age relevant educational standards [14, 40]. The language skills on which explicit teaching should focus include:

- phonological awareness - the ability to discriminate and manipulate the sounds of a language;
- text skills - the ability to use language at sentence level and above;
- linking sounds and written language,
- 'world' knowledge - knowledge of the way language works, of the concepts and content being talked or written about, and how to use language appropriately in different contexts [14, 40, 84].

Teachers can identify the gaps that are present in a student's language development by taping and analysing their oral language, and analysing samples of written language [40]. It is important to involve an Indigenous teaching assistant when analysing language samples, to be sure that patterns associated with the student's home language are not mistaken for errors associated with hearing loss. A range of other assessment tools - commercially produced or teacher generated – is also available and can be used in the classroom to monitor and inform language development.

Phonological awareness

Students with hearing loss should receive explicit teaching that focuses on development of the oral language skills that underlie written literacy, including phonological awareness skills [14, 99].

Phonological awareness is concerned with the reception and production of the sounds of a language, and includes knowledge of rhyme and rhythm, the ability to discriminate sounds in all word positions (beginning, middle and end), blend sounds, divide words into syllables, and manipulate sounds [16]. These skills will typically be developed in the classroom through activities such as rhymes, songs and poems, rhyming stories, learning letter names and sounds, and playing word games [40].

Indigenous children face several issues in terms of the development of phonological awareness and subsequent written literacy [40]. For many children living in remote areas, Standard Australian English (SAE) is a second or subsequent language or dialect, and their home language and literacy experiences are often wholly oral. Extensive hearing loss during their early childhood years may lead to poor development of their first language or dialect, and result in an inadequate foundation on which to build language skills in a subsequent language or dialect. In addition, little is known about how the development of phonological awareness in Indigenous languages differs from that for SAE, and a normal pattern of development would be difficult to determine due to the extent of hearing loss in some communities. It is essential that assessments of language skills are culturally and linguistically appropriate for speakers of Indigenous languages so that language difference is not mistaken for language disorder [100, 101].

For Indigenous students with hearing loss, there are several areas of phonology that are likely to cause particular problems, because the sounds are not part of their first language or dialect (for example, voicing, the difference between 'p' and 'b' or 't' and 'd', is not distinctive in most Indigenous languages) [40, 102]. Indigenous children will need explicit teaching in hearing and producing various consonant and vowel sounds in all word positions. Even when sounds are common to their home language and SAE, students may require explicit instruction to address the effects of hearing loss on the development of language skills.

Phonological awareness needs to be learned by all children in the early years of literacy development, but it is important that teachers of Indigenous students with hearing loss continue to teach these skills explicitly and consistently beyond Pre-primary and Year 1 levels [14]. In addition, older students who struggle with written literacy are likely to have missed out on vital foundational learning in their early years, and will need help to develop these skills and enhance their educational opportunities [40].

Text level skills

A focus on text level skills, such as development of vocabulary, familiarity with parts of speech, sentence structure and different text genres, the meaning of words and concepts, and the ability to produce and comprehend extended language is also important [14].

Text level skills are taught in the classroom through activities such as telling stories, recounting events, describing procedures, and planning activities [40]. Indigenous children have a rich heritage of oral language through which text level skills may initially be developed, but children with hearing loss often miss out on valuable language input and have limited vocabularies. Classroom activities will need to focus on description (for example, adjectives and adverbs), specificity (for example, use of prepositions, expressing size and distance), and relational language (for example, reasons/explanations, cause/effect, similarity/difference etc.), which are common areas of weakness for children with hearing loss.

Linking sounds to written language

Students also need to be able to link sounds with their written forms to confirm the link between spoken and written language [14, 40]. Effective teachers explicitly link sounds to written language. Important strategies include maintaining a print-rich environment in the classroom, developing students' concepts of print, and helping students to encode the sounds of SAE and to understand that there is no one-to-one sound-symbol correspondence in English.

'World' knowledge

Indigenous students should also be assisted to develop 'world knowledge' that builds on their existing experiences [14]. World knowledge is knowledge of the way language works [40], and encompasses the different ways of using language in different contexts and the life experiences that enable children to make sense of what they are reading and hearing about.

Many students with hearing loss may have more limited knowledge of language and life because they are not able to hear properly or to participate fully in activities [40]. To maximise their learning opportunities, they will need input on a variety of topics and concepts in a variety of ways.

Teachers should provide information to students that enables them to use SAE appropriately in various social contexts and settings [14]. They should also inform students of the meanings of concepts that may be unfamiliar to them. Working thematically is recommended as it gives more intense and prolonged exposure to content that can be used to develop a variety of language skills [40].

Because of the linguistic, cultural, and social differences that Indigenous students experience in the classroom environment it is important to focus on developing world knowledge beyond years 1 and 2 into the middle years of primary schooling [14].

Placing teaching in context and using interaction styles

Other strategies can be adopted to help hearing and hearing-impaired children adjust to unfamiliar cultural and linguistic aspects of a mainstream educational setting, and to create a classroom environment that respects different ways of interacting [14].

Teaching can be placed in context by relating the acquisition of literacy learning to the specific cultural and linguistic differences and needs of students [14]. Many Indigenous students will function more confidently in an unfamiliar school environment if they are explicitly taught the differences between home ways and school ways, and between their first language and SAE.

Teachers should adopt interaction styles that are compatible with those in the students' communities [40], and use appropriate non-verbal cues so that children are able to respond effectively [14]. Strategies that are compatible with Indigenous interaction styles include:

- use of indirect or information-seeking questions (that seek information the teacher does not already have) rather than display questions (that seek answers in order to test the student's knowledge, reveal whether the student is paying attention, or control the student);
- use of group work and peer tutoring;
- longer wait times; and;
- positive rather than negative reinforcement [103-108].

Non-Indigenous teachers need to learn these culturally based communication and teaching strategies, and this should form part of both pre-service and in-service teacher education programs. Indigenous teachers should be encouraged and supported to utilise their existing culturally based skills in the education of Indigenous children with hearing loss [87] (this is discussed in more detail on pg. 43 where the policy implications for reducing hearing loss through education interventions are considered).

Using a variety of teaching methods

Using a variety of teaching methods can also assist children with hearing loss [14, 40]. Small group work and one-to-one teaching are likely to increase opportunities for hearing and learning. This occurs because the listening demands are reduced when teaching groups are smaller, it is easier for students to attend to non-verbal cues, and there are more opportunities for student to seek clarification if they do not understand. If Indigenous teaching assistants are available, they will be able to provide further assistance by monitoring children with hearing loss and helping them to participate [88].

Increasing student awareness of hearing problems

Teachers have a critical role to play in the development of education strategies that will help improve the quality of the listening and learning environment for children with hearing loss. However, students can also play a role in this if teachers raise awareness of hearing problems and help them to become more responsible for the quality of their own listening and learning environment [14, 40, 84].

Health and science lessons provide an opportunity for children to learn about hearing loss, and about the role of good nutrition, hygiene and physical activity in promoting ear health [40]. Lessons can also include discussions of ways students can minimise classroom noise. As children get older, they can be taught to recognise the symptoms of conductive hearing loss, and be encouraged to take responsibility for letting the teacher know that they are having a bad hearing day, as well as organising themselves to facilitate listening.

Implementing new education strategies

The teaching strategies outlined above will be most readily implemented in schools where teachers are encouraged and supported to explore innovative approaches to engage students [45]. However, even without broader institutional support, individual teachers can enhance the listening and learning of Indigenous students by focusing on specific strategies.

Adapting teaching strategies to the particular needs of Indigenous students has been shown to bring about change in student learning and retention [45]. The readiness of teachers to implement new strategies may be influenced, however, by a range of personal, conceptual, cultural and workplace factors, including their understanding of the need for change, the perception of rewards for change, time required to implement change, competing priorities, and leadership influences.

Many of the strategies proposed above are based on concepts and activities that are already familiar to teachers, so they should seemingly have few problems implementing them [45]. However, there can be barriers to the effective implementation of new strategies. For example, teachers may assess students' language skills inappropriately, and move students on to more complex text level skills to the exclusion of phonological skills before they have a sufficiently firm foundation in phonological awareness. Consequently, such students may struggle with written literacy. On the other hand, teachers may assume because students appear not to be able to read certain materials or do certain written work that they lack the foundational skills and keep working on those, when in fact the students have 'bluffed' them and are well able to handle more advanced work. Another barrier to implementing new strategies is issues with attendance. If students are frequently absent, they miss out learning some of the new material. This issue can be exacerbated at class level if a proportion of the class is absent at different times. In such circumstances, teachers trying to teach the class as a whole group (rather than in several smaller, more homogeneous groups) have to keep returning to the early material each time a student returns. This can become very complex in terms of classroom management, and some teachers may find it logistically too difficult and give up trying to implement new strategies. A further issue that can impact negatively is the spread of ability in classes and the need to develop individual education plans to cater for differing abilities. Again, some teachers may feel this situation makes it too difficult for them to implement new ways. Finally, some teachers will misunderstand different ways of behaving that reflect cultural norms of Indigenous students, but are different from what non-Indigenous teachers are used to. Some teachers may perceive these as disruptive, rather than recognising that different cultural norms are involved and that they need to learn different ways of interacting which will be compatible with Indigenous interaction patterns. Because of misinterpretation of cultural differences some teachers may avoid attempting to implement new strategies.

Many teachers, particularly those in rural and remote areas, are likely to be familiar with ear health and hearing problems, but may not be aware of the implications for language development, or perceived behavioural problems [45]. Teachers may also be aware of the availability of hearing test results, but few appear to make use of this resource to assist in planning appropriate ways of working with students with identified hearing loss.

Research findings recommend that teachers be more conscious of accessing records of hearing loss, relating Indigenous cultural characteristics to classroom contexts, and exploring the possibility that certain apparently negative behaviours may be a consequence of conductive hearing loss [45].

Innovative school-based initiatives that address OM and the educational consequences of hearing loss among Indigenous students have begun to receive some support from government policies, plans and programs [25]. Projects initiated in response to this support and implemented in individual schools have reported some success [25, 109] but it has been noted that inadequate capacity in many schools frequently hampers efforts to implement effective educational interventions to improve outcomes [110].

The following section discusses the extent to which the educational consequences of OM and hearing loss have been recognised in government policies. Existing health and education policies

that refer to OM and hearing loss are discussed, but many other government policy documents have yet to consistently recognise the links between Indigenous education and health, or the educational implications of hearing loss. Nor do they adequately address the need for joint action across relevant portfolios and between Commonwealth, State and Territory government agencies, communities, schools, parents and students.

The final section of this review discusses recommendations for ear health and hearing that will have implications for the development of holistic, cross-portfolio policies to reduce hearing loss and its educational consequences for Indigenous people.

Policies to reduce hearing loss and its educational consequences for Indigenous people

Over the years, reports of educational performance have repeatedly identified significantly worse outcomes among Indigenous students than among non-Indigenous students [109, 111, 112]. The development of Indigenous-specific education policy to address poor educational outcomes did not receive much attention until after 1967, and it is only in more recent years that the range of issues that lie outside the traditional sphere of education, but continue to hamper progress in educational outcomes (including physical health issues such as ear disease and hearing loss), have been recognised [109, 113].

Compared with non-Indigenous students, relatively few Indigenous students experience educational success at school [114]. They typically demonstrate considerably poorer attendance and retention, and their low levels of performance (evidenced by outcomes from national benchmark testing) deteriorate further with age. A recent report [113] to the Australian Parliament, by the Minister for Education, Science and Training, outlines the outcomes of Indigenous education and training in 2005. It confirms that there has been little overall improvement in Indigenous attendance and retention rates in recent years. It also reports that in 2005, Indigenous students scored lower on eight of nine benchmarks than they did in 2004, and that the gaps between Indigenous and non-Indigenous outcomes are tending to widen. There are many reasons, both historical and contemporary, for poor educational outcomes among Indigenous students, including factors associated with colonisation and more recent societal issues [114].

Governments in Australia first gave real consideration to addressing poor educational outcomes through the development of Indigenous-specific education policy after the 1967 Referendum, which provided the Commonwealth with the power to legislate on behalf of Indigenous peoples [109, 113]. Following the Referendum, various Commonwealth policy initiatives, often run in conjunction with State and Territory governments, were implemented to address issues directly affecting Indigenous people. They foreshadowed reform in Indigenous education, and the Australian Government now funds core Indigenous education programs across the country. The programs are designed as strategic interventions to supplement general programs, and are now administered by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR).

During the 1970s and 1980s, various inquiries and reviews outlined the state of Indigenous education and quantified the disparity between Indigenous and non-Indigenous attendance, retention and performance [109, 111, 112] The National Aboriginal and Torres Strait Islander Education Policy (AEP) was announced in 1989 [115]. The policy has undergone several revisions, but remains in place today. It was the first attempt to set directions in the area of linking policy, schools and communities [109], and since its introduction there has been a continuing focus on the need to improve outcomes for Indigenous students, with a range of programs initiated to address this [114]. Initiatives implemented in individual schools have demonstrated successful strategies for improving educational performance [25], but there is currently no evidence that such solutions are sustainable and transferable to broader educational settings [109]. It has been noted that inadequate capacity in many schools has hampered efforts to implement the policies, plans and programs designed by governments [110].

Despite revisions since its release in 1989, the goals of the AEP do not fully consider more recent understanding of the social environment in which Indigenous children and young people live, and the range of institutional, historical and socioeconomic factors in which poor educational outcomes are embedded [110]. Health issues such as OM and hearing loss are now widely recognised as contributing in part to the poor educational performance of Indigenous students. Conversely, it is also now widely accepted that obtaining a good education is an important factor in improving the health and wellbeing of Indigenous people [26], and will lead to improved employment prospects, income, standard of housing, and access to health care [86]. Despite the current wisdom regarding the links between Indigenous education and health the development of policy in this area has to date been relatively limited, and the need for more holistic strategies is increasingly acknowledged. The peak inter-governmental forum in Australia, the Council of Australian Governments (COAG), is now promoting a whole of government approach to the provision of flexible services and programs for Indigenous people. This suggests that Indigenous education policy can no longer continue to be developed in isolation from other areas that address health and wellbeing.

In the last two decades, Indigenous health policy has explicitly recognised the burden of OM and hearing loss experienced by Indigenous people, and has more recently begun to recognise the need for school ear health and hearing policies that will contribute to efforts to address the educational consequences of hearing loss. Some policy documents in the education sector have also considered the contribution of hearing loss to Indigenous educational outcomes, but hearing loss remains a largely overlooked and poorly addressed issue in Indigenous education policy. Health and education policies and strategies that have given consideration to Indigenous OM and hearing loss are discussed briefly in the following sections.

Health policies and strategies

The health sector prioritised the need to address the high levels of OM and hearing loss in Indigenous populations in the 1989 National Aboriginal Health Strategy (NAHS) [116]. The first systematic national response to Indigenous ear health and hearing loss was implemented following the development of the National Aboriginal and Torres Strait Islander Hearing Strategy 1995–99 [117]. This strategy focused on strengthening the capacity of comprehensive primary health care services to address ear disease and hearing loss in the 0-5 years age group [64].

A review of the National Aboriginal and Torres Strait Islander Hearing Strategy 1995-99 was released in 2002 [64]. The review contains a set of policy principles and strategies that build on the national strategy and guide future action in the areas of service delivery, workforce, access to and coordination of primary, secondary and tertiary ear health and hearing services, research, intersectoral collaboration, and local linkages. The review highlighted the need for action in remote, poorly-serviced areas where persistently high levels of chronic OM and OM-related hearing loss among children reflect the limited effectiveness of health services and inadequate access to tertiary hearing services [64].

Based on findings from the review, the Work Plan for Future Actions in Ear and Hearing Health was released by the Department of Health and Ageing in 2003 [118]. The Work Plan focuses on six policy principles, including the need to:

- position ear health within a comprehensive, population-based approach to family, maternal and child health;
- improve primary, secondary and tertiary management of OM and hearing loss;
- develop and implement school ear health and hearing policies that use intersectoral approaches to advance the use of technological systems and training (including the use of video otoscopy, sound-field amplification systems and other innovative approaches).

Education policies and strategies

At about the same time that health policies and strategies were recognising the importance of hearing issues among Indigenous people, some education policies and strategies were identifying hearing loss as an important factor contributing to Indigenous educational outcomes. However, many other Commonwealth, State and Territory education policy documents have not consistently recognised the importance of OM and hearing loss for Indigenous educational performance. Education policies that do consider the educational consequences of OM and hearing loss are discussed below.

In 2000, the findings of a Australian Senate education inquiry were published in Katu Kalpa: report on the inquiry into the effectiveness of education and training programs for Indigenous Australians [86]. The report identified ear disease and associated hearing loss as one of the most significant learning barriers faced by Indigenous students. The learning and hearing needs of Indigenous students subsequently received specific attention and funding under the National Indigenous English Literacy and Numeracy Strategy (NIELNS) 2000-2004 [119].

Key elements of the NIELNS were based on findings from the Australian Government's Strategic Results Projects (SRPs)[2]. Analysis of the SRPs suggested that improved literacy and numeracy outcomes for Indigenous students would require education providers to address a number of key areas, including a focus on ear health and hearing [120, 121].

The National Indigenous English Literacy and Numeracy Strategy (NIELNS) 2000-2004 [119] was launched by the then Prime Minister John Howard in March 2000 [121]. The objective of the strategy was to achieve English literacy and numeracy for Indigenous students at levels comparable to those achieved by other young Australians. The development of a special Indigenous strategy reflected growing recognition of the multiple disadvantages that undermine the success of many Indigenous students and preclude them from reaching the literacy and numeracy levels they require to participate fully in the wider Australian society [119].

The strategy identified six key elements that need to be addressed to ensure the success of Indigenous students [119]. Key element 2 involves effectively addressing the hearing and other health problems that undermine learning for a large proportion of

2 The SRPs were undertaken in the late 1990s as part of the Indigenous Education Strategic Initiatives Programme (IESIP SRPs) [25]. This Australian Government initiative set out to explore how educational outcomes for Indigenous students may be improved quickly through dedicated resources and effort. It funded State and Territory government and non-government preschool, school and VET sectors to develop short, focused education and training initiatives.

Indigenous students. It requires effective joint action across relevant portfolios and between Commonwealth, State and Territory government agencies, communities, schools, parents and students. Hearing issues are recognised in two of the four overarching initiatives identified under this key element

- introduction of effective hearing assessments and interventions linked with best practice literacy and numeracy; and
- regular health screening programs for school children [119].

These initiatives aimed to facilitate cooperation between health and education agencies in order to provide students with hearing assessments on entry to preschool and school, and then at regular intervals through their school years [119]. Support for those students who were identified by the hearing assessments as requiring assistance would include

- providing hearing aids, FM audio systems or individual hearing supports;
- managing referrals and follow-up medical interventions for those needing treatment; and
- assisting teachers to adopt teaching techniques that accommodate hearing problems.

Other key elements of the NIELNS address improving school attendance, preschool participation, teacher recruitment, training and retention, teaching methods, and measuring and achieving success and accountability [119].

Implementation of the NIELNS required development of a wide range of specific plans and initiatives with States, Territories and Indigenous communities [119]. Most health assessments and related initiatives were delivered by independent providers in the pre-school sector, and involved a program of activities including hearing and health checks and daily 'breathe, blow and cough' exercises.

Government providers undertook several major projects to provide hearing assessments and raise awareness about OM and hearing loss [121]. In South Australia, the Department of Education and Children's Services implemented hearing screening tests in Anangu schools and provided follow-up treatment and adaptive aids in the classroom. At the time of the evaluation, it was reported that attendance rates had improved. In Western Australia, the Education Department undertook to identify children affected by OM in several regions. Staff in those regions received professional development for teaching children with hearing impairment, classroom acoustics were addressed, amplification systems were installed, and families received information about treating and preventing OM. In New South Wales, the Department of Education and Training implemented an initiative to provide teacher training to identify and assist children with hearing loss.

The NIELNS Program was evaluated between November 2001 and December 2003, with the findings documented in the Final report of the national evaluation of National Indigenous English Literacy and Numeracy Strategy (NIELNS) [121]. The evaluation found that the program was helping to lay the foundations for improved literacy and numeracy outcomes by enhancing student readiness for learning, but noted that improving literacy and numeracy outcomes was a long-term objective and an ambitious one for a program with relatively modest funding [121].

At the time of the evaluation, results regarding the success of implemented projects were not conclusive but early indications were positive [121]. It was too soon to demonstrate improvements in literacy and numeracy, but a survey of providers' perceptions indicated that the majority of respondents felt that their NIELNS project had made a moderate or major impact on improving the hearing health of Indigenous students.

The evaluation concluded that addressing health and hearing were key factors in achieving readiness for learning, but questioned whether the responsibility for addressing these issues should be assumed by an education department [121]. The Indigenous Reference Group (IRG) that assisted and guided the evaluation considered that the role of the education portfolios is to ensure that the health and family services portfolios address health issues that affect Indigenous children's achievement in school. They proposed that the then Australian Government Department of Education, Science and Training (DEST) negotiate with health portfolios at Commonwealth, State and Territory levels to obtain funding for health and nutrition problems that affect educational achievement [121].

At the same time that the NIELNS was being implemented, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) Taskforce on Indigenous Education was acknowledging the broad disadvantage facing Indigenous people that affected the ability of policy makers, service providers and Indigenous people themselves to improve educational outcomes [81, 122]. MCEETYA facilitates coordination and consultation between governments to develop and implement policy in the school sector. Through MCEETYA, all Australian governments have committed to improving education outcomes for Indigenous and non-Indigenous Australians [123, 124].

The MCEETYA discussion paper Solid foundations: health and education partnership for Indigenous children aged 0 to 8 years [81] highlighted the need for cross-portfolio initiatives to address health and education issues. The discussion paper:

- recognised the close relationship between health and educational outcomes;

- acknowledged the current synergies operating in the education and health sectors to improve outcomes for Indigenous children; and
- identified the need for further cross-portfolio work to reduce morbidity and improve educational outcomes among Indigenous children [81].

The discussion paper summarised advice regarding the poor health of many students and its impact on student learning [81]. It examined a range of health issues that affect Indigenous children, including chronic ear infections.

The Taskforce acknowledged that there was likely to be considerable geographical variation in health and educational outcomes across Indigenous communities [81]. It proposed that the education and health sectors jointly identify and explore this variation, and relevant examples of effective practice, with a view to promoting advice at the local level. The Taskforce also proposed that a cross-portfolio working group be established to take this work forward. The discussion paper provides a basis for informing discussion and work across health, education, Indigenous affairs, and the family and community services sectors at a national, state and regional level.

The concluding section of this review discusses a range of current ear health and hearing recommendations that will have implications for the development of future policy. These issues highlight the need, identified by the NIELNS and MCEETYA, for close collaboration between sectors and government agencies to improve ear health among Indigenous people, and address the educational and social consequences of hearing loss [81].

Policy implications for reducing hearing loss and its educational consequences for Indigenous people

Over the years, research and programs addressing the medical aspects of hearing loss have been initiated, but the educational, social, emotional, family and community effects have received much less attention [9]. A comprehensive and intersectoral approach that specifically targets prevention and early intervention is now recommended and is discussed below [64]. Other recommendations, discussed in subsequent sections, suggest that this will need to be complemented by efforts to improve:

- access to hearing services;
- hearing health in early childhood (0-5 years);
- education interventions for schoolchildren with hearing loss; and
- the social and emotional wellbeing of hearing impaired children, adolescents and adults.

Prevention and early intervention

Reducing the incidence of OM and the impact of hearing loss will only be possible if efforts are made to address broader problems associated with the poverty, lack of educational opportunities, and high unemployment that exists in many remote Indigenous communities [8, 24]. It has been argued, for example, that:

Only with urgent attention to improving housing and access to running water, nutrition and quality of care, and giving communities greater control over these improvements, will this massive public health problem be solved so that Aboriginal children can take their rightful place in this, the century of communication. [8]

Improvements in OM and hearing loss will require substantial investment into a range of services that include health, education, housing, transportation, and recreation [8, 24].

Significant improvements in the social and environmental conditions that underlie high rates of OM and hearing loss will need to be coupled with early interventions for OM and hearing loss. Early intervention and management of OM and associated hearing loss have been hampered by: lack of effective primary health care services; poor compliance with medical interventions; and poor access to specialist services [8, 62]. Effective, accessible health services and programs will be necessary to minimise and control the impact of ear disease and hearing loss among Indigenous people [64].

Hearing services

Initiatives that increase access to health and rehabilitative services for the detection, management and rehabilitation of ear health and hearing needs must continue, but calls have been made for the Commonwealth to reform the provision of rehabilitative services [8], and to increase the capacity of the Commonwealth Hearing Services Program to better respond to the hearing needs of Indigenous people [64]. The lack of specialist services in rural and remote areas requires initiatives to provide access to specialist and allied health service providers [64].

It has also been suggested that a register of hearing-impaired children may help Indigenous health organisations to coordinate specialist and rehabilitative service referrals and facilitate follow-up [2]. A separate register for children requiring hearing aids has also been proposed. Such a database may assist Indigenous health workers in their efforts to promote the use of hearing aids, identify obstacles to their use, and act as an advocate for families needing special school services.

For more detailed discussion of the policy implications associated with medical aspects of the prevention and management of OM and hearing loss, see the Ear*InfoNet* Review of ear health and hearing.

Focusing on early childhood: 0-5 year olds

The National Aboriginal and Torres Strait Islander Hearing Strategy 1995-1999 identified the need to focus on prevention and access to hearing services [117]. It also recognised the importance of improving hearing health for Indigenous children aged 0-5 years, but this has not typically been a focus of Indigenous hearing programs nationally [125], and few initiatives have targeted this age group [64].

In 2003, the Office of Aboriginal and Torres Strait Islander Health released a Work plan for future actions in ear and hearing health [118]. The plan recommended that hearing health be placed in a holistic, family and community-based context consistent with the Indigenous approach to health envisaged in the National Aboriginal Health Strategy [116]. For such an approach to be successful, it would need to empower communities, provide appropriate training and support for hearing workers, have the support of adequate resources and funding, promote links between hearing workers and early childhood services, and be based on a better understanding of the effectiveness of preventive programs [125].

Research undertaken in Victoria with Koori children aged 0-5 years has highlighted the importance of addressing children's general growth and development, and supporting families and communities, in order to reduce risk factors for ear infections and improve ear health [126]. Recommendations arising from the research include:

- improving access to maternal and child health services;
- supporting Koori childcare centres and playgroups to ensure adequate hygiene facilities and infection control;
- continuing community-based Koori playgroups, childcare centres and health services to support families with Koori children;
- offering families financial counselling;
- improving food security and healthy eating;
- offering support to establish and maintain housing security;
- offering support to give up smoking;
- supporting breastfeeding;
- offering counselling and stress-reduction techniques; and
- offering initiatives to prevent family violence and separation and improve reconciliation.

Like health interventions, education interventions in the early years are likely to be more successful and less costly than remediation and rehabilitation in later years [81]. It has been recognised for some time that effectively targeting 0-5 year olds will have the greatest long-term benefits for OM-related hearing loss and its impact on the pre-lingual and language development periods. This can be encompassed within a holistic approach that positions ear disease and hearing health within a comprehensive population-based family, maternal and child health context [64].

Education interventions

Increasing the focus on 0-5 year old children is critical, but effective ongoing care and support for older, hearing-impaired children and adults will still be needed [64]. To date, many initiatives have focused on school-aged children, and school policies and programs to identify and address hearing loss among students are still recommended [64, 83, 84, 99].

It has been suggested that the consistent implementation of hearing screening programs during the early school years would assist in the identification of children with OM who require medical management and educational intervention [39]. Consultation and partnership with local Indigenous organisations in the development of such initiatives would be very important.

Intersectoral collaborative approaches to develop and implement school ear health and hearing policies that advance the use of technological systems and training have also been recommended [64]. More specifically, it has been proposed that the Australian Government departments of health and education work collaboratively to develop a comprehensive national policy for:

- consistent and ongoing implementation of school policy with respect to ear health and hearing of Indigenous students;
- supply of, and support for, installation and maintenance of sound-field amplification systems in schools where hearing loss is of high prevalence; and
- development of training packages for teachers working with hearing impaired students and families [64].

There may be a need, as identified in New Zealand, for implementation of sound-field amplification systems to be accompanied by a comprehensive study into classroom acoustics in primary schools . The New Zealand study recommended that:

- all possible improvements to room acoustics, and insulation against noise should be undertaken before consideration is given to the appropriateness of sound-field amplification systems for use in classrooms;
- classrooms in new schools should be designed to meet acoustical standards; and
- teacher training should include information on hearing loss, acoustics, and vocal strain.

In classrooms where the installation of sound-field amplification systems is warranted and leads to improved listening conditions, it will still be necessary for teachers to implement learning initiatives to address the consequences of past hearing loss and improve educational outcomes [69]. As outlined earlier various educational strategies are recommended (see Education strategies addressing hearing loss among Indigenous people),, such as early literacy programs that include phonological awareness training activities [39]. The introduction of such measures, together with professional development activities designed for teachers and teaching assistants, will minimise educational disadvantage among hearing-impaired students. In various regions throughout Australia, education and health departments have implemented in-service programs to raise awareness among teaching staff of the educational implications of OM and associated hearing loss and to equip them with strategies to cater to the needs of hearing impaired children [39].

It has been emphasised that the training of non-Indigenous teachers will need to adequately prepare them for cross-cultural classrooms, where a significant number of Indigenous students have hearing loss [87]. The importance of class support from Indigenous adults was recognised in the recommendations that:

- education systems recruit, train and retain Indigenous teachers; and
- teacher training and professional practice support Indigenous teachers being able to utilise culturally based communication and teaching strategies [87].

Where schools do not have sufficient Indigenous staff, efforts should be made to involve Indigenous community members [83].

Social and emotional consequences of hearing loss

The educational consequences of hearing loss have implications for hearing-impaired students at school, and so too do the social and emotional consequences: 'We know that emotion is very important to the educative process because it drives attention, which drives learning and memory' . Creating an atmosphere that encourages the integration of emotional and social development with academic and cognitive growth is very important, but it is often an overlooked aspect of teaching . There is evidence in Australia of positive classroom outcomes from training teachers about ways to prevent classroom behaviour problems associated with hearing problems .

The social and emotional consequences of hearing loss are not limited to the classroom and may also cause significant problems in the home lives of Indigenous families [9]. In the United States, efforts to address the social and psychological problems experienced by deaf children have been extended beyond the school environment to the home . A study of the effectiveness of the PATHS (Promoting Alternative Thinking Strategies) Curriculum – a school-based preventive intervention model designed to improve children's self control, emotional understanding, and problem-solving skills for better cognitive and academic performance –found that PATHS was effective in promoting improved social and cognitive competence for deaf children. These findings led to changes in the curriculum to provide increased focus on such areas as self-esteem, peer relations and conflict, active problem solving, and managing emotions .

There is also evidence that the effects of hearing loss on social and emotional development in childhood may lead to greater contact with the criminal justice system in adolescence and adulthood [22]. This highlights the need for police, counsel/lawyers and judicial officers to be aware that Indigenous defendants may have a history of chronic hearing loss that may contribute to linguistic and communication difficulties and subsequent social and psychological problems. They should be aware that hearing loss may explain communication difficulties, inappropriate demeanour and even the criminal conduct itself. Defendants with communication and behavioural problems associated with hearing loss require unique consideration at each stage of the criminal justice process, including arrest, bail, questioning and confessions, fitness to plead, communication with counsel, communication in court, and sentencing [22].

More recently, it has been noted that the invisible nature of hearing loss means that few are aware of the associated social problems in Indigenous communities. There is very little research into the social, emotional, family, educational and community effects of hearing loss, with more formal research required into the best supports for:

- parents as they deal with the effects of conductive hearing loss in the home;
- hearing-impaired children at school and hearing-impaired adults in the community; and
- staff addressing substance abuse or family violence with hearing-impaired clients [9].

Concluding comments

Despite recognition of the links between education and health, government support for research and policy development around Indigenous ear disease and hearing loss has occurred mainly in the medical sector, with far less attention given to the educational, social, emotional, family and community effects of Indigenous hearing loss [9].

Existing knowledge of the educational implications of Indigenous hearing loss has often not translated into the development of effective Indigenous education policy and practice. The literature consistently identifies a range of issues that will need to be addressed to improve Indigenous ear health and hearing and address the educational and social consequences of hearing loss. For example, further research and resources will be needed to:

- improve Indigenous access to health, education and other services related to hearing loss;
- develop health and education interventions for children aged 0-5 years;
- implement school-based initiatives that address classroom acoustics and advance the use of technological systems (e.g. sound-field amplification systems);
- design appropriate pre-service and in-service teacher education programs;
- support involvement of Indigenous teachers and community members with Indigenous hearing-impaired students;
- transfer successful school-based initiatives into sustainable large-scale education programs;
- understand the effects of hearing loss on the social and emotional wellbeing of children and adults;
- provide support to Indigenous families and communities dealing with hearing-impaired children and adults; and
- develop appropriate criminal justice processes for hearing-impaired defendants.

More detailed interpretation of the research results from across all relevant sectors is beyond the scope of this review. The development of a thorough review that includes detailed interpretation of the research findings from various disciplines is warranted, but will require collaboration and contributions from experts across various sectors. Until this occurs it is anticipated that this review will contribute to further interpretation of the research, policy and practice, and future cross-sector discussions.

Some health and education policies have begun to acknowledge the educational and social consequences of hearing loss, but a more holistic, coordinated approach, supported by evidence from medical and social research, and by adequate funding for the implementation of interventions, will be necessary to minimise hearing loss and its affect on the educational achievement of Indigenous students [8] . This will require closer collaboration between health, education and other relevant agencies and service providers at Commonwealth, State, Territory and regional levels [81].

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Australian Indigenous
HealthInfoNet

The Australian Indigenous Health*InfoNet* is an innovative Internet resource that contributes to 'closing the gap' in health between Indigenous and other Australians by informing practice and policy in Indigenous health.

Two concepts underpin the Health*InfoNet*'s work. The first is evidence-informed decision-making, whereby practitioners and policy-makers have access to the best available research and other information. This concept is linked with that of translational research (TR), which involves making research and other information available in a form that has immediate, practical utility. Implementation of these two concepts involves synthesis, exchange and ethical application of knowledge through ongoing interaction with key stakeholders.

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